# Driver Drowsiness Detection System for Vehicle Safety

*Sanchit Singla and Arpit Thakur*

*Assistant Professor, LPU Phagwara*

**Abstract**

As the Automobile industry is looking up to a massive growth every year, new technologies and innovations have played a big part in it's growth, whether it is about the performance of a vehicle or the new features added to it. The Driver Drowsiness Detection System is an Active Safety feature added to vehicles to prevent accidents that occur due to the driver falling asleep, feeling drowsy or not being able to concentrate on the road because of fatigue. Various studies around the world have proved that more than 20% of all road accidents are caused due to these issues and to minimize these risks while driving, various new methods have been developed and introduced to the modern vehicles to tackle the outcome of such events. Many technological giants have worked hard for really long time to develop a system that detects and prevents miss happenings that occur due to fatigue or drowsiness of a driver. This paper is based on the example of finding a sleep plan. The purpose of this paper is to help create an automated driver safety system that can detect the physical conditions of a driver and take appropriate actions to maintain the safety. The Driver Drowsiness Detection System is an union of multiple on-board sensors, micro- controller, radar, cameras, etc. combined with computer programming. The system is designed in such a way that it can detect whatever actions a driver is taking, this system can detect the alertness of a driver to his yawning to the blink of an eye.

## I. Introduction

Driving while feeling drowsy is one of the major causes of road accidents. Current research shows that 1 out of 5 accidents is caused by the driver's lack of alertness, which accounts for about 20% of all traffic accidents and is gradually increasing each passing year. The study highlights the fact that the total number of deaths every year due to drowsiness or fatigue can be reduced drastically by using a basic combination of hardware and software. Driving has become a nightmare for many people due to the inclement weather, bad road conditions, traffic congestion and speeding but some other reasons that also affect a driver even when it's not his fault are drowsiness, drunk driving and careless driving by other drivers who are on the road and this can be taken care of if all vehicles come pre- equipped Driver Drowsiness Detection System which can keep a check on the driver at all times and react to whatever conditions the driver is in. To provide the required safety measures, the vehicles are loaded with an automated safety system that alerts the driver through a beep or an alarm, and in some high end modern vehicles the vehicle automatically slows itself down and drives to the corner lane and stops if the user is irresponsive. This is done through many parameter that include alcohol sensor, eyes size and blink detection, yawn detection, steering response pattern, acceleration and deceleration pattern, etc. All vehicles should be equipped with an eye blink sensor and alcohol sensor to avoid these types of accidents. The purpose of the project is to use an IR sensor for instantaneous measurement and control. Infrared radiation is transmitted through an IR transmitter to the driver's eye. The eye reflects the infrared radiation transmitted by these The reflected rays is received by the IR receiver. When the eye is in the closed position, the output of the IR receiver is high. The output of the IR receiver is low, if the eye is in an open position. This indicates that the eye is in the opening or closing position. The alarm is displayed, if the output is provided in a logical cycle. This project reduces the risk of comatose in the eye.

## II. Existing System

Volvo was the first company to come out with a Driver Drowsiness Detection System in 2007, which they called Driver Alert Control. Many existing systems require a camera installed in front of the driver. It points directly at the driver's face and monitors the driver's eyes for drowsiness. In big vehicles like trucks and buses the system does not work. The bus has a large windshield window for a wide range of safe driving views. When we place the camera in the windshield window, the camera prevents the driver's front view visibility. If the camera is mounted on a frame about the window, then the camera cannot capture the inner view of the driver's face properly. An open CV detector detects only 40% of the driver's face in a normal driving position on a 10-minute record. From an oblique point of view, the Open CV eye detector (CV-ED) always fails to follow the eyes. While running continuous iterations, if the system finds that the driver's eyes were closed for 5 consecutive frames, it concludes that the driver is drowsy and sets up an alert or warning for him. So the existing system does not work in large vehicles. To overcome the problem of an existing system, a new acquisition system is being developed for this project.

## Proposed System

To build a basic prototype, a blink eye sensor and the optical sensor is used to detect the driver's drowsiness and alert the driver with a buzzer. The sensor basically checks the size of the river's eye, the time of an eye blink, the number of blinks in a certain period of time, etc. And than by the help of a computer program, if it finds something

wrong, the system gives an output and alerts the driver. The various hardware components used for building a prototype are listed below

1. LPC2148 micro controller
2. Eye blink sensor
3. Alcohol sensor
4. Tilt sensor
5. LDR
6. LCD and buzzer
7. GSM and GPS

The block diagram for the implemented project is shown below

**A. Power supply**

For the prototype system, a 12V power supply is used for the transmission phase and the receiver phase, the conversion of recipients of A.C to D.C. and to reduce the voltage, a step down transformer is used.

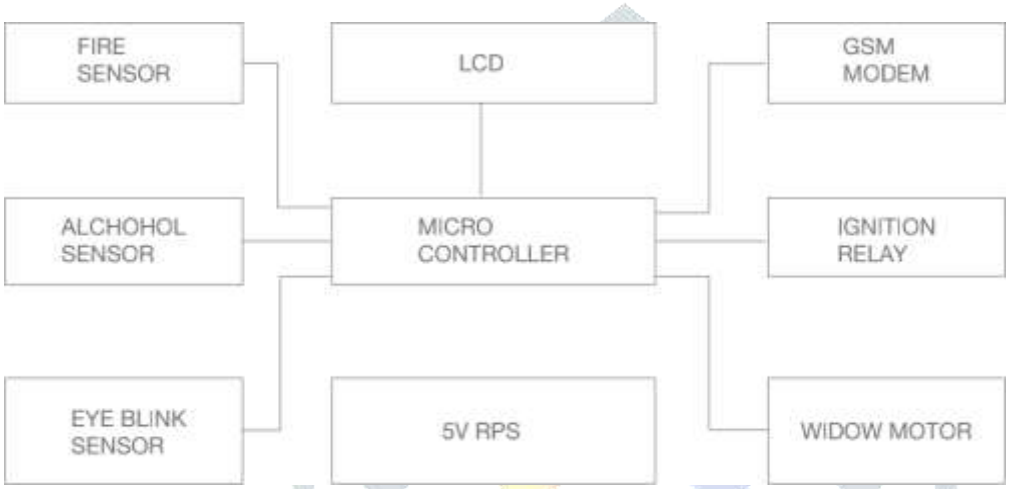


**Fig1: Block diagram**

**B. Microcontroller Section**

Here the microcontroller section is the prototype's control unit. It contains a Microcontroller connected to Crystal with capacitors, Drag resistors, and reset circuits and so on. The heart of the project is the microcontroller because it controls integrated devices. Communicating with devices through the computer program coaded into it.

Here is a 16-bit / 32-bit ARM7TDMI-S controller with a small package with no down tracks. It supports up to 40KB RAM and 512KB in chip flash ROM and supports crystal frequency of 60MHz used for high speed operation.

**C. Eye blink sensor**

The blink sensor is one of the most important parts for the prototype to operate properly. It is mainly of two types, IR Sensor based camera based. The IR sensor based Eye Blink Sensor sends signals to see if eye is closed or there is a camera based sensor in which the instructions are based on image processing. If there is no eyelid movement it creates a certain set of stage i.e. longer time than normal human blinking time and is considered a "blink". At this time the paper should be set as 5 seconds or more, as "blinking event" is different from "normal eye blink". The test will be performed for the normal blink of an eye.

**IR sensor**

To diagnose drowsiness, using an optical light sensor, which is IR based on Fig 2. it consists of 2 main parts, an IR Transmitter and an IR Receiver. Thensmitter transmits IR rays into the eye and the receiver checks if the

trarays returned or not. If the driver's eye is shut, then the output is high. If the eye is open, then the output is low.

The IR transmitter and the IR receiver are configured parallel. When the signal is turned on, the IR sensor starts working and the IR transmitter emits infrared radiations. The scale corresponds to the IR receiver. The operating amplifier is attached to the comparator. In the inverting input of the comparator voltage reference is given, the comparator is linked to the receiver. Where there is interference with IR radiation between sender (sender) and receiver (receiver), the IR receiver will not operate. The voltage at the inverting input base is therefore lower than the constant input voltage. The result of the comparison is therefore high. The output power of the comparator is supplied by the microcontroller. When the IR receiver receives radiation from the transmitter, the IR receiver starts working as the static power of the fixed terminal is less than the power of the diver generator. The result of the comparison is therefore low. The output rating is therefore set to the controller. This region is used to calculate the movement of the eyelid.

**Fig 2: Eye blink sensor**

**D. Alcohol Sensor**

The concentration of alcohol in the driver's respiratory tract is detected by the use of an alcohol sensor. The sensor provides analog output based on alcohol concentration. The MQ-3 sensor is used as the alcohol sensor is shown in Fig. 3. The alcohol sensor has a better sensitivity and faster response time. Butane, propane, alcohol, tobacco, smoke, LNG are detectable through this.

The MQ-3 sensor has six anchors. Here 4 pins are used to detect signals and the other two anchors are used to provide current and heat. The MQ-3 sensor has a sensitive SnO2 sensor, which has a low flow rate in unsafe air. When alcohol is present, nerve conduction is elevated and alcohol concentration increases.

**Fig 3: Alcohol sensor**

**E. Tilt Sensor**

Depending on the variation in the movement of an object, the tilt sensor produces an electrical signal to notify about the movement of the object. These sensors are used to calculate the slope, elevation and depression within the minimum range of motion. Sometimes, inclinometers are used as a tilt sensor because the sensor generates a signal but an inclinometer creates both read and send signals. Used to detect falls. It works like a changer.

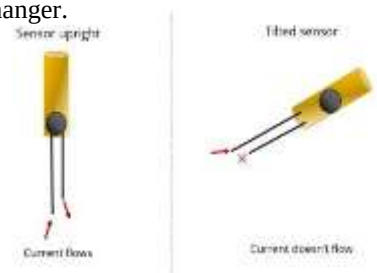


**Fig 4: Tilt sensor**

**F. Light Dependent Resistor**

A Light dependent resistor (LDR) is also called as a photo resistor or a cadmium sulfide (CdS) cell is shown in fig 5. It is also known as a photoconductor.


**Fig 5: LDR**

LDR is actually a photocell that works on the photoconductivity principal. It is a basic act of opposition. LDR resistance increases with increasing light.


**Fig 5.1:LDR working**

The zigzag track shown in Fig. 5.1 is a cadmium sulphide (CdS) film. The lower and upper metal films are attached to the final directions. It is designed to create areas that are in close contact with two metal films. The configuration is enclosed in a plastic or resin case, to provide access to external light. Cadmium sulphide (CdS) is a major component of LDR formation. It is used as a photoconductor and contains very few electrons. When the lamp is not present the LDR resistance is high. Electrons are released and material conduction increases as light increases.When light exceeds a certain frequency,photons are attracted to the semiconductor and provide the electron energy needed to move to the steering band. As a result electrons or free holes conduct electricity and thus reduce resistance (1 <1 Kilo ohm).

The following figure is used to show the relationship between resistance and lighting is written as R = A.E ^ a
(1)
Here E lights up (lux) R resistance
(ohms)
In equation (1) The value depends on the CdS used and the method of production. "Number range" between 0.7 and 9.9.

**G. Buzzer Section**

A buzzer is used to warn or signal the process termination and the Buzzer also shows the start of an embedded program with a warning.

**H. LCD Section**

This LCD section is used to illustrate the status of the event. The Liquid Crystal Display (LCD) is used to display or prompt for necessary information.

**I. Global Positioning System**

The location of any object or vehicle is determined using satellite signals by Global positioning system (GPS) technology. Receiving a receiver in a 3D space requires three satellite signals and a fourth satellite is accurate. Details of longitude, latitude and attitude are provided by GPS. By using longitude, latitude and mental limits to any object can be measured. In GPS technology, the connection is between the GPS transceiver and the GPS satellite.

**J. Global system for mobile communication**

The global telecommunications system (GSM) is a technology that supports most of the world's mobile networks. GSM technology is growing exponentially with wireless technology and the unique story of global acquisition through expanded partnerships. GSM is a fast communication technology. Using voice-to-speech service and digital technology. In GSM technology the data transfer speed reaches 9.6 kbps and allows streaming of basic data services such as SMS.

**H. DC MOTOR**

The car contains a permanent magnetic field stator and rotor. By using electric waves or a permanent magnet, the magnetic field is maintained. With variable speed and torque, DC motors are used.

## SOFTWARE TOOLS

### A. Keil compiler

To create software to be run on embedded system. It allows code to be written in assembly or in any programming language and that code is simulated on a computer before being loaded onto the controller unit. Micro vision 3 is an integrated Development Environment that helps to write a program. It compiles and runs embedded programs.

### B. Flash magic

Flash magic is a PC tool for setting up NXP-based microcontrollers using a Ethernet protocol or serial while on targeted hardware. Streak magic is used to send a hex ode to the controller.

## III. DESCRIPTION

For the prototype to function properly, the required operating voltage of the controller LPC2148 is 3.3V and 5V DC power supply is required for integrated chips. Using the Bridge Rectifier, the controlled 3.3V is made with reduced power consumption from 230V to 3.3V. The reduced AC voltage is now adjusted using diodes of 1N4007. The output power of the rectifier is filtered using a C filter. In order to have a constant controlled current, a voltage regulator is used. 1000uf electrolytic capacitor is used to adjust voltage, filter and control the system. The output of this section is now supplied with a microcontroller to supply electrical power.

This project aims to check if the driver is sleepy or tired or has used alcohol. Along with this, the secondary aim of this project is also to build an automated driver safety system for improper driving. The system contains optical sensor, alcohol sensor, tilt sensor, LDR etc. The assembly of devices in the microcontroller is shown in fig6. An important block in this project is the IR-based eye blink sensor. IR radiation is transmitted by eye contact. The indicated IR radiation from the eye is received by the recipient. If there is interference with the IR radiation between the transmitter and the receiver it means that the eye is in a closed state, the IR receiver does not gets the radiation back, the voltage at the final input terminal of the comparator reduces the final input power of the constant input. Therefore the output of the comparator is high and this voltage is given to the controller. Used to detect the opening or closing of a driver's eye. So whenever the driver feels sleepy, the optical sensor detects the blindfold and alerts the driver through a buzzer and it is also displayed on the LCD. The blink of an eye is recorded and measured with an eye blink sensor placed near the eye and this information is transmitted in the form of a pod and transmitted to the ARM7 microcontroller. Using this information, the ARM7 controller will compare to the standard encoded blinking criteria. In the unlikely event of an accident, an alcohol sensor is used to let the driver know if he should be driving or not. The alcohol sensor is used to determine if the driver has used alcohol or not. If the driver is intoxicated, alcohol concentration is detected by the MQ-3 sensor; critical SnO2 conductivity is elevated and provides analog output to the microcontroller. The microcontroller sends a warning signal via an LCD displayed in fig7.

The tilt sensor is used to detect whether a car has been involved in an accident or not. If the vehicle is involved in an accident, the tilt sensor generates an electrical signal to the microcontroller, through which GSM provides information to the person concerned that the vehicle has been involved in an accident. Using GPS where the car is located. The LDR is used to detect the presence of light inside the vehicle. When the bright light is low in the car, the LDR resistance is high (mega ohms). As the light intensity increases in the LDR, the electrons are released and cargo is increased and the lights will hit the car.

The effectiveness of this program is explained in a step-by-step process. Step 1: The first process of all the sensors checking the driver's condition.

Step 2: When the data is collected, the blink of an eye, alcohol level, etc. The data is processed using the scale and magnifier

Step 3: Check if the driver is normal or somewhat drowsy or in sleepy position

Step 4: In normal conditions, if the driver's condition are fine, the comparator output is GND and LP2148 control is provided and the buzzer is off and no alarm is sounded.

Step 5: Alternatively if sleep mode is detected (where the drowsiness or fatigue of the driver is detected), the output gauge is high given to the microcontroller and the buzzer is turned on to inform the driver.

Step 6: When alcohol is found, the SnO2 drive is raised and provides an analog output to the controller and displayed on the LCD

Step 7: In the unfortunate event of an accident, the information is provided via GSM to authorized persons along with the location of the driver.

Step 8: When the light intensity is low, the lights will turn on inside the car.

## IV. RESULT

The figure 6 shows the prototype which is a combination of all the hardware used for this system. Here we have designed a very basic system for the eye blink to be continuously monitored by the eye blink sensor

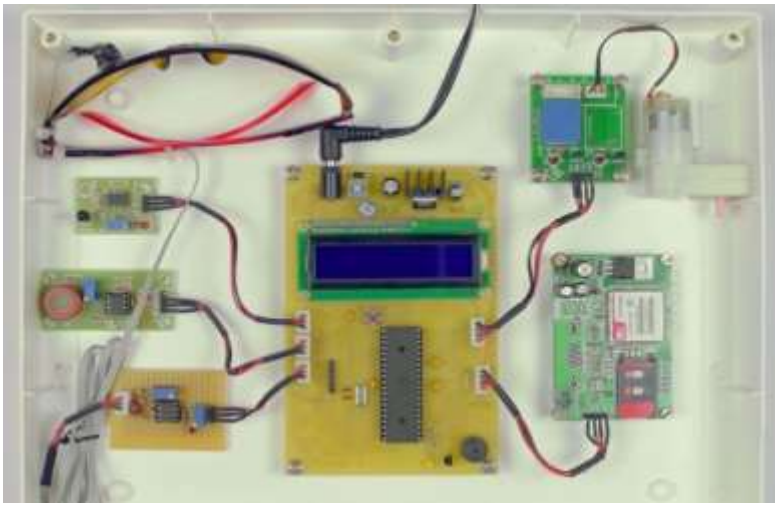

**Fig 6: Driver drowsiness detection system**


**Fig7: Alcohol detection**

When the alcohol sensor senses the presence of alcohol it alerts the driver by pointing to a LCD warning him that he's not in a condition to drive.

## V. ADVANTAGES

The various benefits of the system used are listed below

1. Detection of drowsiness and pre alert the driver as a measure of Active Safety
2. Decreased number road accidents (up to 20%)
3. Good performance with low margin of error
4. The system is cheap and highly effective

## VI. APPLICATIONS

The drowsiness detection system can be used for a variety of purposes. One of them is for heavy vehicles. For example trucks, because truck drivers have drive more distance and for longer period of time. It can also be used with commercial vehicles. Many people use the public transportation system to get around. For their safety the system can be used on public vehicles. The system can also be used for cranes as they lift and carry heavy objects and then moved to other locations. Therefore for overloaded cranes and mobile cranes this system can be used to avoid the dangers associated with drowsiness.

## VII. CONCLUSION

The Driver Drowsiness System is analyzes the condition of the driver and in case it detects that the driver is not fit for driving at any point of time, the system sends a warning to the driver through different methods. In this paper, the discussion on how to avoid accidents due to drowsiness is discussed and a basic prototype system was developed that can be used at high numbers to avert misshapenings. The project was successfully tested. And these systems developed with the help of growing technologies such as GSM and GPS project have been successfully implemented in many high end vehicles and with the prices of modern technology equipments going down, these can also be implemented in cheaper cars, commercial vehicles and public transports.

## ACKNOWLEDGMENT

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